

NEAR-SIGHTEDNESS IN SCHOOLS :

ITS CAUSES, PREVALENCE, AND PREVENTIVES.

BY B. G. NORTHROP,

SECRETARY CONNECTICUT BOARD OF EDUCATION.

[REPRINTED FROM THE REPORT OF THE STATE BOARD OF EDUCATION.]

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The recent growth of near-sightedness in America, and its wider prevalence in Germany, render the discussion of this subject timely and important. The latest investigations of oculists clearly prove that myopia is not only a *disease*, but one that predisposes to more serious ocular troubles; a disease almost always originated during school life, or at least under twenty-one years of age, and yet preventable by the *early* use of proper precautions. As my knowledge of this subject is experimental and non-professional, I quote the letters and opinions of eminent oculists and physicians, who endorse the views expressed in this paper as justly meriting the attention of school-officers, teachers and parents. Though it be a new topic for a State Educational Report, the interests of thousands of children whose eyes are needlessly suffering, demand its consideration.

NEAR-SIGHTEDNESS IN SCHOOLS.

Being near-sighted myself, I took a deep interest in the investigations recently carried on in Germany as to the causes and prevention of this trouble. Eminent oculists in that country have carefully examined the eyes of thousands of children, and the general conclusion which they regard as fully established is that there is a gradual increase of myopia in the ascending grades from the primary school to the gymnasium.

Sight is the noblest avenue of the mind and its impairment or loss is a greater evil than would be that of any other bodily sense. Because the near-sighted when old can read without glasses, their eyes have been supposed to be peculiarly strong. But oculists are now agreed that myopia is a disease which predisposes its subjects to more serious trouble. The great number of myopes who become partially or totally blind shows the necessity of investigating the causes and preventives of near-sightedness. This disease is more prevalent in Germany than in any other country of the world, and the subject has lately commanded the attention of her Reichstag as well as of her most distinguished physicians. In her schools sixty-two per cent. are myopic, while in America, so far as the examinations extend, the rate is about twenty-seven per cent.

In Germany many of the school houses are very old structures originally built for convents and poorly lighted. The German text itself is obscure compared with the clear Roman letters. With all their conservatism and reverence for ancient forms and usage, many German scholars advocate the adoption

of the plainer Roman letters. Especially in the smaller type, the German text has needlessly taxed the eyes of her people. Professor Donders, the highest authority on this subject in Europe, says: "Near-sightedness is most common in cultivated nations, and among the States of Europe visited by me, nowhere did I meet so many myopes as in Germany." The absence of near-sightedness among savages is an argument for the theory that one cause is undue tension of the eyes for near objects. Germany is confessedly one of the most studious nations of the world. Its scholars are especially sedentary in their habits, study more hours a day and have less fondness for games, sports, out-door scenes and exercise than American students, and are less watchful in regard to ventilation. Ruete dwells on the deleterious effects of insufficient and faulty illumination. Admirable as is the "German student's lamp" its use is limited. I often found scholars in German families studying by the flickering light of candles, and was frequently unable to get good light for my night work.

Among the causes of visual weakness among American youth may be named a stooping posture, which cramps the chest and brings the eye too near the book or paper; reading at twilight and late at night, and studying by lamp-light in the morning; reading in the cars; using kerosene lamps without shade; reading while facing a window, or any light, natural or artificial, and still more while facing the bright sunshine; reading dime novels or other books printed in too fine type (all books printed in diamond, pearl, agate, or nonpareil, are unfit for childrens' eyes); wearing a veil; and neglecting to cultivate far-sightedness by examining carefully distant objects. Hence myopia is more common in cities than in the country, among those working on near and minute objects than those laboring in the fields with a wider range of vision and more objects to invite habits of observation. The increase of myopia has been attributed to modern devotion to literary pursuits, as savages are generally exempt from this trouble. But if proper precautions are taken, there is no necessity that myopia should increase in a nation in proportion to its devotion to intellectual pursuits. Though it is often hereditary, this predisposition may commonly be counteracted by proper care.

Says Dr. E. G. Loring, "The great period for the development of myopia, that is, for its *beginning*, is from the tenth to the fifteenth year, just at the time when the body as a whole is developing most rapidly. Near-sightedness is essentially a disease of childhood, or at the latest of adolescent life. Donders declares that he never has seen a case of myopia *originate* after the twentieth year. Myopia is especially prevalent among the so-called cultivated classes. Yet students do not use their eyes for more hours a day and on finer objects, than jewelers, engravers, draughtsmen, seamstresses, type-setters, and many others who engage in long continued work on small objects. These occupations do not show any tendency to near-sightedness, while the professional and literary callings do. The principal reason why the members of mechanical arts show less myopia than those of studious and literary occupations, is not because they use their eyes less, but that the application of the eyes occurs at a different time of life and under entirely different conditions."

The statistics already gathered in this country as well as in Europe clearly show that there is an increasing tendency to myopia in the ascending grades of schools. To illustrate the extent and thoroughness of these investigations both in Europe and America, Dr. Erismann's statistics were made in St. Petersburg on the eyes of 4,358 scholars, Dr. Conrad's at Königsberg on 3,036. Dr. Cohn at Breslau examined 10,060 pupils. Dr. Pluger examined 1,846 pupils at Lucerne. Though I had gathered the results of these inquiries from a wide field of observation abroad, I give mainly the facts and conclusions found at home as likely to have more weight with teachers, school-officers and parents. Dr. Cornelius R. Agnew has kindly furnished me the following detailed and tabulated statements of 1,479 students whose eyes have been recently examined.

Of these, 630 were examined by Drs. Williams and Ayers of Cincinnati, Ohio, 549 by Dr. W. Cheatham of New York, now of Louisville, Ky., and 300 by Drs. Prout and Mathewson of Brooklyn.

In Cincinnati the students examined were those of the District, Intermediate, Normal and High Schools; in New York, of the Introductory Class, Freshmen, Sophomores, Juniors, and

Seniors of the New York College; in Brooklyn, of the Academic and Collegiate Departments of the Polytechnic Institute. In all, or nearly all cases, the refraction was first determined by the use of trial glasses and afterwards corrected by the ophthalmoscope. In making up the statistics the preference has been given to the refraction as determined by the ophthalmoscope in all cases in which it differed from that by glasses. It is proper to say that the smallest deviation emmetropia noted was $\frac{1}{7\frac{1}{2}}$ and that a considerable proportion of the cases of ametropia were of $\frac{1}{4\frac{1}{8}}$ or less.

The following abbreviations are used :

* E.=Emmetropia; M.=Myopia; H.=Hypermetropia; A.=Astigmatism; Ah.=Hypermetropic Astigmatism; Am.=Myopic Astigmatism; M.+Am.=compound Myopic Astigmatism; H.+Ah.=compound Hypermetropic Astigmatism.

TABLE I.—*Showing the results of the examination of 630 students in the District, Intermediate, Normal and High Schools, Cincinnati, Ohio.*

DISTRICT SCHOOLS, 209 SCHOLARS EXAMINED.

E.	175	E. 83½ per cent.	Ah.	5	
M.	20		H.	7	
Am.	1	M. 10 per cent.	H. + Ah.	1	H. 6½ per cent.

INTERMEDIATE SCHOOLS, 210 SCHOLARS EXAMINED.

E.	167	E. 80 per cent.	M. + Am.	1	M. 14 per cent.
M.	23		H.	10	
Am.	6		Ah.	2	H. 6 per cent.

NORMAL AND HIGH SCHOOLS, 211 SCHOLARS EXAMINED.

E.	165	E. 78 per cent.	H.	8	
M.	29		Ah.	4	H. 6 per cent.
Am.	5	M. 16 per cent.			

* The following explanation of these technical terms may be necessary.

Emmetropia = normal measured—standard eye. In such an eye rays of light come to a focus on the retina without muscular effort.

Hypermetropia = over-sighted, in contradicition to Myopia or near-sighted. Such an eye is *too short* in its antero-posterior axis; parallel rays of light come to a focus *behind* the retina; can only be brought to a focus on the retina by a muscular effort.

Astigmatism = no $\left\{ \begin{array}{l} \text{point} \\ \text{focus} \end{array} \right.$; such an eye under no circumstances focuses the rays upon the retina. It is due to a difference in the curves of the different diameters of the eye; i. e. the radius of curvature, for instance, is different from that of the radius of curvature of the horizontal meridian.

TABLE II.—*Showing the results of the examination of 549 students in the New York College.*

INTRODUCTORY CLASS, 335 SCHOLARS EXAMINED.

E. both eyes, -----	192	E. 57½ per cent.
M. both equally, -----	16	
M. both unequally, -----	23	
Am. both equally, -----	9	
Am. both unequally, -----	3	
M. + Am. both equally, -----	4	
M. + Am. both unequally, -----	10	
Am. one, the other H., -----	1	
M. one, the other Am., -----	1	
M. one, the other M. + Am., -----	13	
Am. one, the other E., -----	9	
M. + Am. one, the other E., -----	1	
M. one, the other E., -----	6	
M. one, the other Amblyopic, -----	1	
M. + Am. one, the other Amblyopic, -----	1	
Am. one, the other M. + Am., -----	1	M. 29 per cent.
H. both equally, -----	9	
H. both unequally, -----	6	
Ah. both equally, -----	4	
Ah. both unequally, -----	1	
H. one, the other E., -----	14	
Ah. one, the other E., -----	6	H. 12 per cent.
E. one, the other irregular astig., -----	3	
E. one, the other Amblyopic, -----	1	
Irregular astigmatism both, -----	1	1½ per cent.

FRESHMEN, 103 SCHOLARS EXAMINED.

E. both, -----	44	E. 42½ per cent.
M. both equally, -----	2	
M. both unequally, -----	6	
Am. both equally, -----	5	
Am. both unequally, -----	1	
M. + Am. both equally, -----	3	
M. + Am. both unequally, -----	7	
M. one, the other M. + Am., -----	1	
M. one, the other E., -----	2	
Am. one, the other E., -----	5	
Am. one, the other M. + Am., -----	5	
M. one, the other H., -----	1	
M. + Am. one, the other H., -----	1	
M. + Am. one, the other Ah., -----	1	
Am. one, the other Ah., -----	1	M. 40 per cent.
H. both equally, -----	1	
H. both unequally, -----	4	
Ah. both equally, -----	3	
Ah. both unequally, -----	3	
H. one, the other E., -----	5	H. 15½ per cent.
E. one, the other Amblyopic, -----	2	2 per cent.

SOPHOMORES, 57 SCHOLARS EXAMINED.

E. both, -----	34	E. 59½ per cent.
M. both equally, -----	3	
M. both unequally, -----	6	
Am. both equally, -----	3	

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M. + Am. both unequally,-----	1	
M. + Am. one, the other Am.,-----	2	
M. + Am. one, the other E.,-----	2	
Am. one, the other E.,-----	1	
M. one, the other E.,-----	2	M. 35 $\frac{1}{4}$ per cent.
H. both equally,-----	2	
H. one, the other E.,-----	1	H. 5 $\frac{1}{4}$ per cent.

JUNIORS, 30 SCHOLARS EXAMINED.

E. both,-----	11	E. 36 $\frac{2}{3}$ per cent.
M. both equally,-----	4	
M. both unequally,-----	5	
M. + Am. both unequally,-----	3	
M. one, the other M. + Am.,-----	1	
M. one, the other E.,-----	3	
Am. one, the other E.,-----	1	M. 56 $\frac{2}{3}$ per cent.
H. both unequally,-----	1	
H. one, the other E.,-----	1	H. 6 $\frac{2}{3}$ per cent.

SENIORS, 24 SCHOLARS EXAMINED.

E. both,-----	12	E. 50 per cent.
M. both equally,-----	2	
M. both unequally,-----	5	
M. + Am. both unequally,-----	2	M. 37 $\frac{1}{2}$ per cent.
H. both equally,-----	3	H. 12 $\frac{1}{2}$ per. cent.

TABLE III.—*Showing the results of the examination of 300 students in the Polytechnic Institute, Brooklyn.*

ACADEMIC DEPARTMENT, 142 SCHOLARS EXAMINED.

E. both,-----	79	E. 56 per cent.
M. both equally,-----	6	
M. both unequally,-----	6	
M. one, the other E.,-----	2	M. 10 per cent.
H. both equally,-----	22	
H. both unequally,-----	6	
H. one, the other E.,-----	19	
H. one, the other Amblyopic,-----	1	H. 34 per cent.
E. one, the other Amblyopic,-----	1	

COLLEGIATE DEPARTMENT, 158 SCHOLARS EXAMINED.

E. both,-----	84	E. 53 per cent.
M. both equally,-----	15	
M. both unequally,-----	8	
Am. both equally,-----	1	
Am. both unequally,-----	1	
M. + Am. both equally,-----	1	
M. + Am. both unequally,-----	1	
M. + Am. one, the other Am.,-----	1	
M. one, the other E.,-----	17	M. 28 $\frac{1}{2}$ per cent.
H. both equally,-----	17	
H. both unequally,-----	4	
H. one, the other E.,-----	7	
H. one, the other Amblyopic,-----	1	H. 18 $\frac{1}{2}$ per cent.

It will be observed by reference to the above tables that the refraction of each eye was determined separately in the New York and Brooklyn examinations, while in the Cincinnati examinations both eyes were examined at once, and consequently the least ametropic eye was probably always taken as expressing the refraction of the scholar.

Of the students examined in Cincinnati, the tables show that there were found to be myopic in one or more meridians of one or both eyes, of those examined in the district schools, ten per cent. ; intermediate schools, fourteen per cent. ; normal and high schools, sixteen per cent.

Of the students examined in the New York College, there were found to be myopic in one or more meridians of one or both eyes ; in the Introductory Class, twenty-nine per cent. ; in the Freshmen, forty per cent. ; in the Sophomores, thirty-five and a quarter per cent. ; in the Juniors, fifty-six and two-thirds per cent. ; and in the Seniors, thirty-seven and a half per cent.

Of the students examined in the Polytechnic Institute, Brooklyn, there were found myopic in one or more meridians of one or both eyes ; in the Academic Department, ten per cent. ; and in the Collegiate Department, twenty-eight and a half per cent. We may simplify matters still further by dividing the students examined into five grades.

I.—District schools, Cincinnati, Ohio.

II.—Intermediate schools, Cincinnati, Ohio ; Introductory Class, New York College, New York ; Academic Department, Polytechnic, Brooklyn, N. Y.

III.—Normal and high schools, Cincinnati, Ohio ; Freshmen, New York College, New York ; Collegiate Department, Polytechnic, Brooklyn, N. Y.

IV.—Sophomores, New York College, New York.

V.—Juniors and Seniors, New York College, New York.

In the *first* grade 209 scholars were examined : $83\frac{1}{2}$ per cent. emmetropic ; $6\frac{1}{2}$ per cent. hypermetropic ; 10 per cent. myopic.

In the *second* grade 687 scholars were examined : 64 per cent. emmetropic ; 15 per cent. hypermetropic ; 21 per cent. myopic.

In the *third* grade 472 scholars were examined ; 62 per cent. emmetropic ; $12\frac{1}{2}$ per cent. hypermetropic ; $25\frac{1}{2}$ per cent. myopic.

In the *fourth* grade 57 scholars were examined : $59\frac{1}{2}$ per cent. emmetropic ; $5\frac{1}{4}$ per cent. hypermetropic ; $35\frac{1}{4}$ per cent. myopic.

In the *fifth* grade 54 scholars were examined: 42 per cent. emmetropic; 9 per cent. hypermetropic; 49 per cent. myopic.

1st grade, myopes, $12\frac{1}{2}$ per cent.; 2d grade, myopes, 21 per cent.; 3d grade, myopes, $25\frac{1}{2}$ per cent.; 4th grade, myopes, $35\frac{1}{4}$ per cent.; 5th grade, myopes, 49 per cent.

The above statistics certainly go to confirm the results of investigations by Cohn and others, namely, that the number of myopes is greater in the advanced classes than in the primary.

The following table (IV) also goes to show that the number of myopes, upon the whole, increases with years.

TABLE IV.—*Showing the number and percentage of myopes corresponding to the different ages.*

Ages.	No. of scholars in Cincinnati schools at the different ages.	No. of scholars in New York College at the different ages.	No. of scholars in the Polytechnic, Brooklyn, at the different ages.	Total No. of scholars at the different ages.	Total No. of myopes at the different ages.	Percentage of myopes at the different ages.
6	20			20	1	5 per cent.
7	42			42	2	$4\frac{1}{2}\frac{1}{3}$ "
8	65			65	5	$7\frac{2}{13}$ "
9	53			53	9	17 "
10	24		8	32	3	$9\frac{3}{8}$ "
11	7		18	25	3	12 "
12	38		26	64	2	$3\frac{1}{8}$ "
13	56		48	104	16	$15\frac{5}{13}$ "
14	83	74	45	202	43	$21\frac{2}{10}\frac{2}{1}$ "
15	46	159	38	243	60	$24\frac{6}{8}\frac{5}{1}$ "
16	51	124	45	220	61	$27\frac{8}{11}$ "
17	63	93	37	193	71	$36\frac{1}{19}\frac{5}{3}$ "
18	52	52	23	127	30	$23\frac{7}{12}\frac{3}{7}$ "
19	23	27	7	57	14	$24\frac{3}{5}\frac{2}{7}$ "
20	5	10	4	19	3	$15\frac{1}{19}$ "
21	1	9		10	5	50 "
22		1		1	1	100 "
24			1	1	0	0 "
26	1			1	0	0 "
	630	549	300	1440	329	$21\frac{4}{7}\frac{3}{2}$ "

Progressive near-sightedness is a disease. A near-sighted eye is not a normal eye. When the child is born in the normal state, the eye is not near-sighted. Now, the eye is an organ which is plastic when the child is born; it is in a condition to be changed in its shape; its tissues are in a condition to be modified by the use which is made of the organ. Commonly the child goes on until it reaches the age of eight or ten years, perhaps a little older, when it is observed that it has to hold whatever it is looking at a little nearer to the eye than previously, and then, on

examination, reveals the fact that the eye is near-sighted. If you follow such a child up to the age of twenty-five or thirty years, it will be found that the near-sightedness has doubled, and perhaps quadrupled. Now, we know, by means of the ophthalmoscope and other means, that the near-sighted eye is changed from the spherical to the elliptical, or ovoid form, and that progressive myopia is always marked by change in the shape of the eye. Inasmuch as the eye is made up of living tissue which is constantly undergoing the process of waste and repair, you can readily perceive that the law inducing the amount of such waste and repair is very much determined by the character of the tissue-building process in each child, and the way in which that child uses the eyes. For example, the child is allowed to sit, perhaps for hours, with the body partly bent, and the face inclined towards a book which rests in the lap while reading; here the accommodation of the eyes is tasked in looking at a minute object while they are in a bad condition, and all this time waste and repair is going on as best it may. The child would go blind in an instant were there no tissue reproduction. Now if the eye is used while the body is in an unfavorable position, it cannot be nourished as it should be, and the pressure of the muscles upon the eyeball and the action of the crystalline lens in focalization must bring about changes which lead to this progressive form of disease. Then let the child go at an early age into a school house where perhaps it will be placed upon work with books, slates or copy-books which could be better done by means of the black boards or models, and again the eyes are strained, and so the unfavorable effects are continued."

I commend the following extract from the last School Report of Hartford to the special attention of teachers and School Visitors. "The fact is established beyond a doubt, wherever proper examinations have been made, both as to schools abroad and schools of this country, that there is a near-sightedness which is thoroughly progressive in its characters, and increases in percentage as the scholars rise from one grade to another. Examinations have recently been made in the public schools of some of our largest cities, particularly of New York, Buffalo, Brooklyn and Cincinnati, and the theory of progressiveness has been very generally sustained, especially in the last named city, where it was found that of the students examined there were ten per cent. near-sighted in the district schools, fourteen per cent. in the intermediate schools, and sixteen per cent. in the high schools. As the results of observations in the Polytechnic Institute, in Brooklyn, near-sightedness was found in ten per cent. of the eyes in the

academic department, and in twenty-eight per cent. in the collegiate department. Abroad, the subject has been longer under consideration, the examinations more thorough and complete, and the results consequently more satisfactory. We gather from a recent article by Dr. Hasket Derby, of Boston, the facts presented below :

About the year 1867, Dr. Cohn, of Breslau, examined the eyes of 10,060 school children and pupils. His results may be summarized as follows : in no school village was myopia found among children who had not yet completed their first half year of work. In these schools, taken as a whole, there was found 1.4 per cent. of myopia. Taking all schools together, and following the scholars, at successive intervals, from the first half year to the fourteenth year of school life, the percentage of myopia was found to be the following :

1st Half Year.	2d Half Yr. to 2d Year.	3d and 4th Years.	5th and 6th Years.	7th and 8th Years.	9th and 10th Years.	11th and 12th Years.	13th and 14th Years.
0.4	4.8	8.6	7.9	11.3	24.1	49.5	63.6

In 1871, Dr. Erismann published the results of his investigations of the condition of the eyes of 4,358 scholars, at various educational establishments in St. Petersburg. The pupils were aged from eight to twenty. Taking the classes in order, the fifth being the most advanced, the following results were obtained :

Class.	Percentage of Myopia.	Class.	Percentage of Myopia.
Preparatory -----	13.6	III -----	30.7
I -----	15.8	IV -----	38.4
II -----	22.4	V -----	41.3

In 1874 and 1875, Dr. Conrad examined the eyes of 3,036 school children, in Königsberg. He found the percentage of myopia to rise as follows :

Class.	Percentage of Myopia.	Class.	Percentage of Myopia.
VIII. (youngest) -----	11.1	IV -----	28.44
VII -----	15.8	III -----	44.39
VI -----	20.5	II -----	54.59
V -----	21.8	I -----	62.10

In 1876, Dr. Pfluger published the results of his investigations in the schools of Lucerne, 1,846 pupils being examined. Myopia was found to be present in the following percentage as to age :

Year of Life.	Percentage of Myopia.	Year of Life.	Percentage of Myopia.
7	0.	15	26.
8	2.	16	30.
9	3.	17	43.
10	6.	18	55.
11	6.5	19	56.
12	6.	20	60.
13	10.	21	61.5
14	14.5		

These statistics are exceedingly valuable as showing that the matter is something more than a mere medical theory, and are fully worthy of the attention of those interested in educational affairs. The cause of this disease is only discoverable by keen observation and thorough examination, that is, not merely an examination of the eyes of school children as they now are, and as in future they pass from one grade to another, but a complete noting of the manner in which these pupils are taught, the construction of rooms in which they study, and a proper rejection of any indications of the evil which they may have had handed down to them from a previous generation. An incorrect system of lighting school rooms is of course one of the chief causes of this growing defect in the eyes of scholars as they advance towards maturity. In all cases the light should come from the left, and at a distance of from four to five feet from the floor. Next to this a rear light is permissible, but light from the right should, if possible, never be used. Windows should never be placed in front of the pupil. The light which he then receives is positively injurious. They should always be placed on the left side; the next best place is the rear, and after this the right side, which position should only be occupied when no other can be obtained. The true light should come from over the left shoulder. It does not harm the eye, does not cast a shadow on the pupil's work, and is, in short, the best light. An English authority, in treating of the subject of ophthalmic diseases, caused by improper light

in school buildings, says: "The remedy is, to have the light sufficiently strong, and fall on the table from the left hand side, and as far as possible from above." There are other important points on this topic. But the proper adjustment of light will be found to be one of the chief factors in the solution of the general difficulty.

The Board has thought sufficiently of this subject to allow, under proper restrictions, examinations to be made in the various schools of the town, believing that even if no adequate remedy for increasing near-sightedness could be discovered from such general observations, the statistics gathered would be of value alike to the cause of education and of science, would assist the members of the medical profession in their laudable attempts to elucidate the matter, and while bringing no harm whatever to the scholars in attendance upon the schools, would be a step forward in that line of progress which should ever be the ambition of all who have public interests at stake and desire to advance the physical and intellectual health of those who are the thankful recipients of public education.

Examinations have been made in the West Middle and South Schools. In the former by Dr. W. T. Bacon, and in the latter by Dr. J. A. Steven. In the West Middle School three hundred and eight scholars were examined. They were members of the intermediate and grammar departments, and were from eight to fifteen years of age. There were found to be fifteen per cent. of the number near-sighted. In one room in which the scholars sat, so as to continuously face the light, twenty-two per cent. of them were myopic; this percentage being twenty per cent. of all those who were proved to be near-sighted. In the other school those examined were in attendance upon the grammar department principally, and were from twelve to fourteen years old. The per cent. of near-sighted pupils was twenty-one. This is a higher percentage than found at the West Middle School, but can easily be accounted for in various ways. The scholars are older and have been at school longer, and the matter of light and air space have not received that attention which has been accorded them in the West Middle School—a new building with more perfect arrangements. The school, too, is over-crowded, and

there are too great a number of desks in many of the rooms. These statements are simply brief outlines of the work accomplished thus far. They are not sufficiently perfect as yet, and will not be until the examinations have progressed further, and been, from to time, repeated. There is, in the results of the examinations, however, enough of facts to show us that they are actually needed, and enough of statistical truth to give food for careful thought and wise deliberation. They are matters which are well worthy of careful attention."

Dr. J. A. Stevens, of Hartford, who has devoted much time to the investigation of myopia in the Public Schools, says:—

"This subject ought to be a matter of interest to all who have the care of children, as near-sighted persons are often ignorant of their own trouble until it becomes progressive, and fully developed, and even then there are but few that realize their danger. It is only within the last few years that attention has been called to its causes, but the more the subject is investigated by the profession, the more apparent does it become that it usually begins during school life, and the more imperative does the duty become of calling upon parents and educators to aid in preventing its development. What is myopia? The anatomical difference between a normal eye and one that is near-sighted is practically a difference in the length of the eye-ball. The normal eye is $\frac{9.5}{10}$ of an inch in diameter from front to back, a little shorter than this from side to side. When the eye is longer than this we have near-sightedness, which varies in degree as the eye varies in length. When the eye is shorter than this measure we have the condition for far or over-sight. An increase in length of $\frac{1}{20}$ of an inch may impair vision for distance considerably, but near objects will be seen as well if held a little closer. The lengthening of the eye-ball takes place in the back part as the cornea in front is more dense and not so yielding as the back, while the sides are supported by the muscles which move the eye. As the eye becomes elongated, the retina which receives impressions is thrown beyond the focus of rays, coming from a distance. Sometimes double vision occurs, and very often cross-eye results, if the myopia is not corrected. In severe cases of myopia, there is often much pain in the eye and surrounding parts. Near-sightedness is

regarded lightly by some as if it were only a slight inconvenience, which will be corrected as age advances, by the flattening of the cornea, which takes place in advanced life. This is true of only very slight cases, and of those congenital cases that are due to an unusual convexity of the cornea, and lens, but these are a very small percentage of near-sighted people. The fact that myopia is an *incurable disease* cannot be emphasized too strongly. When the organic change in the form of the eye has become established, glasses do not cure it. They correct the vision, but the eye never resumes its original form. The disease as it occurs in children is usually *progressive*, and therein lies the danger, and it is this peculiar fact that makes it an important subject in connection with education. The causes that produce the disease at this time of life also operate to increase it.

The more time people spend in intellectual pursuits the more myopia do we find. In writing and study it is easier to sit bending over a desk in a stooping position than in an erect posture. This position prevents by compression the free return of blood from the head. The posture of the head favors its detention in the eyes, while the working of the brain itself, demands more blood, and hence we easily have a congestion of the eye-ball, and especially of those parts that are most active, viz: the retina and optic nerve. With this congestion there occurs softening of the sclerotic or outer coat, and increase of the fluid contents of the eye-ball increasing the pressure from within. The muscles on the sides of the eye in the greater effort at converging for near vision also produce pressure from without. This condition of affairs produces a bulging of the posterior wall, and it is in this way that near-sightedness begins and increases, for the same causes continue to act with greater force as the trouble progresses. In children the tissues of the eye-ball are much softer than in the adult, and this is one reason why these causes are more active in producing the disease between the ages of six and twenty.

From the statistics which have been carefully collected in this country and in Europe we find that myopia exists in school children under six in a very small degree, viz: from 1 to 4 per cent. In older students who have passed through the

primary and grammar schools there is a gradual increase which is more rapid from 8 to 16 than at any other period. At the age of 20 we find the per cent. increasing to from 50 to 60 per cent.; in some German universities 63 per cent. are near-sighted, while the disease exists in much higher degrees. Hygienic habits of the people have something to do with this result, but the great cause of this increase is without doubt long-continued and close application to study. The most important facts these statistics show are that in *healthy eyes* this disease is *produced* by study under unfavorable circumstances and that it is *progressive*. With these facts established, and considering that our facilities for education are increasing with our increasing wealth, there can be no doubt that this disease is increasing with our civilization. In reading fiction people are more apt to hurt the eyes than in other reading or in study, for the simple reason that one will read longer on an interesting subject and not notice fatigue. It is so fascinating that children often continue reading in *dim twilight*, or by poor artificial light, and many young people take a favorite book to bed and acquire the habit of reading themselves to sleep. About three years ago, a young lady of this city lost the sight of one eye by keeping up for several years this practice of reading in bed until she fell asleep. The best position for reading is to sit with the head erect or slightly thrown back, and with the shoulder to the light so as to have the eyes in the shade and the light falling obliquely on the page. The book should be held from twelve to eighteen inches from the eyes, and should be brought up toward the face instead of bending the head to the book. Near-sighted persons are very apt to hold the book nearer than is really necessary to see well. It requires more effort for them to read at the far point of vision, but this practice is a benefit in preventing the increase of the trouble.

After a severe illness of any kind, especially after measles, scarlatina or typhoid fever, the eyes share in the general debility of the body, and recover their power more slowly; hence they should be used only very moderately by convalescents. When the eyes begin to ache and the letters run together, it is a warning that they are being overtaxed and require rest."

Hartford, April 2, 1878.

Mr. B. G. NORTHROP :

My Dear Sir,—I rejoice to hear that you are to speak of the *causes* and *prevention* of near-sightedness in your Report. It is a strictly legitimate subject for that document. The attention of parents and teachers should long ago have been called to it. The evils resulting to the sufferers from this *disease* are not duly appreciated by others. Besides the constant inconvenience and mortification it occasions, it is a serious hindrance in the pursuit of many objects of study, especially in natural science. The best constructed spectacles are poor substitutes for good eyes. My testimony rests upon a long and painful experience.

I remain very truly your friend,

JOHN S. BUTLER.

New Haven, Conn., April 3, 1878.

Rev. B. G. NORTHROP :

Dear Sir,—I have read your paper with much interest. It is undoubtedly true that infirmities of vision, especially among children, are becoming widely prevalent. The subject is one which concerns all, and the extent to which public attention has been drawn to it recently is an indication that its importance is being appreciated. The causes of debility of the eyes, and near-sightedness, which you mention, are correctly stated. These causes, it will be noticed, are, in most instances, preventable—hence, the bad consequences to which they lead may be avoided. If we always used our eyes properly, they would be sound and serviceable to old age, and the use of spectacles would seldom be required.

Very respectfully yours,

LEONARD J. SANFORD.